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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

ED 061340

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

WAXED-BAG-MACHINE OPERATOR (paper goods) 649.885

S-139

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EDUCATION & WELFARE
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U. S. Employment Service in
Cooperation with the
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U. S. DEPARTMENT OF LABOR

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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR BAG-MAKING-MACHINE OPERATOR, CELLOPHANE-BAG-MACHINE OPERATOR, WAXED-BAG-MACHINE OPERATOR 649.885

S-127

Summary

The General Aptitude Test Battery, B-1001, was administered to a sample consisting of two groups of individuals employed as Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator , and Waxed-Bag-Machine Operator 649.885 at the Continental Can Company in Beaumont, Texas, and the Dixie Wax Paper Company in Dallas, Texas. The criterion consisted of broad category supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes S-Spatial Aptitude, P-Form Perception, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator and Waxed-Bag-Machine Operator 649.885 - S-127

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator and Waxed-Bag-Machine Operator 649.885.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-127

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1-F CB-1-H	85	S	Part 3	80
P	CB-1-A CB-1-L	70	P	Part 5 Part 7	70
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV indicate that 13 of the 18 poor workers, or 72 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 72 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 33 of the 38 workers who made qualifying test scores, or 87 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator and Waxed-Bag-Machine Operator 649.585.

II. Sample

During the period May 1954 to August 1956 the GATB, B-1001 was administered to a sample group of 31 workers (30 men and 1 woman) employed as Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator , and Waxed-Bag-Machine Operator at the Continental Can Company in Beaumont, Texas. The GATB, B-1002A, was administered to 24 men employed as Waxed-Bag-Machine Operator 649.585 at the Dixie Wax Paper Company in Dallas, Texas, during the period August 16 to 21, 1957. The workers in the two sample groups were performing substantially the same job duties and the criterion data obtained were comparable. Therefore, on this basis, the data for the two samples were combined to form a total sample of 55 workers (54 men and 1 woman).

The sample group at the Continental Can Company was obtained in two ways--on a longitudinal basis and employed worker basis. The longitudinal study was started in May of 1954, when potential applicants were tested because of expansion of plant facilities. Seventeen applicants were tested and subsequently hired. However, this process seemed too slow for the company and it was agreed to test the 14 employed workers in the plant who had not been tested prior to being hired. This group was tested during July and August 1956. When most of the new hires had one year of experience, ratings were obtained on the group of 31 workers. The training program is a two-year on-the-job program at this plant.

The sample group at the Dixie Wax Paper Company was obtained on a direct basis of employed workers. All the workers in the group had completed an on-the-job training program. Ratings were obtained when they had completed the training program.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations (corrected for broad categories) with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_cr$) for Age, Education, and Experience

Waxed-Bag-Machine Operator 649.885
N = 55

	M	σ	Range	$_cr$
Age (years)	30.9	8.4	19-56	-.212
Education (years)	10.7	1.9	5-13	.398**
Experience (months)	4.5	5.1	1-21	-.156

** Significant at the .01 level

There are no significant correlations with the criterion for age or experience. The correlation between the criterion and education indicates that there is some tendency for the better educated workers to receive higher ratings.

III. Job Descriptions

Job Titles: Bag-Making-Machine Operator
Cellophane-Bag-Machine Operator
Waxed-Bag-Machine Operator 649.885

BAG-MAKING-MACHINE OPERATOR

Job Summary: Sets up and operates a bag making machine to form paper into pouch-shaped bags: Mounts roll of paper in machine, using overhead, hand operated hoist. Attaches end of paper from machine to new roll, using glue. Adjusts guides which align new roll with feeding mechanism. Starts machine by depressing electric switch. Sets speed control lever to appropriate speed. Makes adjustments to machine to assure proper operation according to grade of paper and atmospheric conditions. Ignites gas burner by use of spark lighter to heat paper as it enters rollers of machine. Maintains proper level of glue in glue reservoir. Regulates flow of glue by adjusting tension of glue roll. Observes operation of machine and notes any malfunction or need of adjustment. Makes adjustments, using hand tools or by turning hand wheels. Sets up machine to make specified size, shape and type of bag needed. Notifies foreman when repairs are needed. Periodically lubricates machine, using hand oil can and hand operated grease gun.

CELLOPHANE-BAG-MACHINE OPERATOR
Job Summary: Sets up and operates a bag machine to produce printed cellophane bags: Places machine spindle through center hole in roll of cellophane. Lifts roll of cellophane, using hand operated hoist, and lowers it into place in machine. Threads cellophane through printing mechanism of machine and into bag machine, which automatically folds, cuts and glues to complete each bag. Adjusts machine to produce bags of specified size by turning handwheels and adjustment set screws and changing replaceable parts. Starts machine by depressing electric switch and observes operation of machine. Makes adjustments to control the tension of the cellophane and rollers to conform to atmospheric conditions which affect the working properties of the material. Estimates amount of cellophane needed for each run of bags and requisitions it from warehouse. Periodically lubricates machine, using hand oil can and hand operated grease gun.

WAXED-BAG-MACHINE OPERATOR
Job Summary: Sets up and operates a machine to make bags from glassine paper: Mounts roll of paper in machine, using an overhead, hand-operated hoist. Threads end of paper, by hand, through rollers and guides of machine in established manner. Starts machine by depressing electric switch. Observes machine operation. Makes necessary adjustments to machine to correct any malfunction, using hand wheels or hand tools. Periodically inspects completed bags to make certain that machine is functioning properly. Periodically lubricates all bearings and bearing surfaces which require liquid lubrication, using hand oil can. Forces lubricant into fittings provided on machine, using hand operated grease gun. Changes adjustments and attachments when type and size of bag being produced is to be altered, using hand tools. Notifies foreman when machine is in need of repair.

IV. Experimental Battery

All the tests of the GATB, B-1001 and/or B-1002A, were administered to the sample groups.

V. Criterion

The criterion for each sample consisted of broad category ratings made by two supervisors in each plant and based on the workers' abilities to perform their duties as machine operators. These ratings were expressed in terms of "good," "average," and "poor" on the worker's abilities to perform assigned duties. The respective criterion groups (good, average, and poor) for the two sample groups were combined into one criterion distribution for the total sample of 55 workers. The number of workers classified into each category and the quantitative score corresponding to each category, computed for purposes of the statistical analysis, are shown below:

Category	N	Quantitative Score
Good	19	61
Average	18	50
Poor	18	39

VI. Statistical and Qualitative Analysis

A. Statistical Analysis:

Since the sample group at the Continental Can Company was tested with the B-1001 edition of the GATB, it was necessary to convert the aptitude scores for this group to equivalent B-1002 scores. The conversions were based on standard score equations for B-1001 and B-1002 aptitude scores. Means, standard deviations, and correlations with the criterion were calculated for the B-1002 aptitude scores for the total sample of 55 workers.

Table III shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_cr$) for for the Aptitudes of the GATB

Bag-Making-Machine Operator
Cellophane-Bag-Machine Operator
Waxed-Bag-Machine Operator 6498,
N = 55

Aptitudes	M	σ	$_cr$
G-Intelligence	88.9	14.2	.596**
V-Verbal Aptitude	85.9	13.1	.348**
N-Numerical Aptitude	89.4	17.3	.396**
S-Spatial Aptitude	93.9#	19.4	.576**
P-Form Perception	90.2	19.4	.396**
Q-Clerical Perception	86.7	15.1	.243
K-Motor Coordination	87.8	18.4	.128
F-Finger Dexterity	88.4	17.5	.126
M-Manual Dexterity	96.6#	21.0	.262

** Significant at the .01 level
* Significant at the .05 level
# Highest Mean Scores

B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to set up machines and to make adjustments to assure proper operation according to grade of paper and atmospheric conditions.

Spatial Aptitude (S) and Form Perception (P) - required to observe operation of machine to note any malfunction or need of adjustment, to align rolls of paper with feeding machanism, to adjust machine, to produce bags of specified size, and to periodically inspect completed bags.

Manual Dexterity (M) - required to use hand tools and to adjust, oil, and service machines.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes G, S, P, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	High Mean Score	Significant Correlation with the Criterion	Importance indicated by Qualitative Analysis
G		X	X
S	X	X	X
P		X	X
M	X		X

Although Aptitudes V and N show significant correlations with the criterion for this sample, these aptitudes were not considered further for inclusion in the norms because there was no qualitative or other quantitative evidence of significance.

Various combinations of Aptitudes G, S, P, and M, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII was determined.

A comparison of the results showed that norms consisting of S-80, P-70, and M-75 for B-1002 and equivalent norms of S-85, P-70, and M-75 for B-1001 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 5 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized with those workers rated as Good and Average placed in the high criterion group, and with those rated as Poor placed in the low criterion group. This resulted in 18 of the 55 workers, or 33 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes S, P, and M with critical scores of 80, 70, and 75, respectively, and the dichotomized criterion for Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator , and Waxed-Bag-Machine Operator 649.885. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes S, P, and M with Critical Scores of 80, 70, and 75, Respectively, and the Criterion for Bag-Making-Machine Operator ,
Cellophane-Bag-Machine Operator .
Waxed-Bag-Machine Operator 649.885

N = 55

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	33	37
Poor Workers	13	5	18
Total	17	38	55

$r_{tet} = .85$ $\qquad$ $X^2 = 18.606$

$\sigma_{r_{tet}} = .23$ $\qquad$ $P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes S, P, and M, with minimum scores of 80, 70, and 75, respectively, are recommended as B-1002 norms for the occupations of Bag-Making-Machine Operator , Cellophane-Bag-Machine Operators , and Waxed-Bag-Machine Operator 649.885. The equivalent B-1001 norms consist of S-85, P-70, and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-13 which consists of S-75, P-75, and M-75 for B-1002 and S-80, P-75, and M-75 for B-1001. The selective efficiency of OAP-13 for this sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .73 with a standard error of .23 was obtained, which indicates a significant relationship between OAP-13 and the criterion for this experimental sample. The proportion of the sample screened out by OAP-13 was .33, which is within the required range of .10 to .60. Therefore, it is recommended that OAP-13 be used in counseling for the occupations of Bag-Making-Machine Operator , Cellophane-Bag-Machine Operator , and Waxed-Bag-Machine Operator 649.885.